New Genera and Species of Hawaiian Pseudococcidae (Homoptera)[1]

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Only two of the 12 or 13 generally recognized families of the Coccoidea are known to be represented in the endemic fauna of Hawaii; the Pseudococcidae (mealybugs) and the Halimococcidae (palm scales). The latter group contains only three described endemic species which are confined to native *Pritchardia* palms. The endemic mealybug fauna is much more extensive and species are known from a wide range of native vascular plants.

Up to now, 27 endemic mealybugs have been named by Ehrhorn (1912, 1916), Ferris (1948) and Beardsley (1957, 1959, 1963, 1964). At least 40 additional undescribed endemic mealybug species are represented in collections which I have made or received during the past 15 years. Several of these represent new genera. Also, a number of the species which until now have been placed in non-endemic genera (e.g.: *Pedronia*, *Pseudococcus*, and *Trionymus*) need to be reassigned to new endemic genera in the light of recent revisionary studies by Ferris (1950, 1953), McKenzie (1968) and others.

The present paper is intended as the first of a series which, together with earlier studies, will eventually constitute a monographic treatment of the Hawaiian Pseudococcidae. Renewed interest in endemic Hawaiian insects and the roles which they play in the ecology of Hawaiian forest communities, recently engendered by the International Biological Program, Hawaii Subproject, has created the need for names for certain of the undescribed forms. Several of these are described below.

All the named endemic Hawaiian mealybugs, including those described here, are listed in Table 1, with their known hosts and island distributions. The table is based upon type locality and host records and on additional specimens which I have studied. Unverified literature record are not included.

Types of new species are deposited in the Bernice P. Bishop Museum, Honolulu.

Nesopedronia, new genus.

Type of genus: *Pedronia hawaiiensis* Ferris.

Recognition characters: Body at maturity oval to elongate-oval; derm membranous to partly or completely sclerotized. Antennae 6 or

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TABLE 1. *Host and Distribution Records of Endemic Hawaiian Pseudococcidae*

	Species	*Hosts*	*Distribution*
1.	*Chlorococcus chloris* (Beardsley)	*Sophora chrysophylla*	Maui, Hawaii
2.	*Chlorococcus longipes* Beardsley	*Myrsine* sp., *lessertiana?*	Maui
3.	*Chlorococcus peleae* (Beardsley)	*Pelea clusiaefolia*	Oahu
4.	*Chlorococcus sparsus* Beardsley	*Clermontia arborescens*	Maui
5.	*Chlorococcus straussiae* (Ehrhorn)	*Straussia, Gouldia, Bobea*	Kauai, Oahu, Maui
6.	*Clavicoccus erinaceus* Ferris	*Abortopetalum sandwicense*	Oahu
7.	*Clavicoccus tribulus* Ferris	*Hibiscus arnottianus*	Oahu
8.	*Gallulacoccus tenorioi* Beardsley	*Metrosideros* sp.	Kauai
9.	*Nesococcus pipturi* Ehrhorn	*Pipturus* sp.	Oahu, Hawaii
10.	*Nesopedronia acanthacauda* (Beardsley	*Dicranopteris owhyhensis*	Oahu
11.	*Nesopedronia cibotii* (Beardsley)	*Cibotium chamissoi*	Oahu, Hawaii
12.	*Nesopedronia crypta* (Beardsley)	*Dicranopteris owhyhensis*	Kauai
13.	*Nesopedronia dura* (Beardsley)	*Dicranopteris linearis*	Oahu
14.	*Nesopedronia hawaiiensis* (Ferris)	*Dicranopteris* spp.	Kauai, Oahu
15.	*Ohiacoccus cryptus* Beardsley	*Metrosideros polymorpha* var. *typica*	Oahu, Hawaii
16.	*Phyllococcus oahuensis* (Ehrhorn)	*Urera sandwicensis, U. glabra*	Oahu, Lanai
17.	*Pseudococcus antricolens* Ferris	*Santalum freycinetianum*	Oahu
18.	*Pseudococcus floriger* Ferris	*Dracaena aurea*	Kauai, Oahu, Molokai, Lanai, Maui
19.	*Pseudococcus gallicola* Ehrhorn	*Santalum littorale*	Oahu
20.	*Pseudococcus lycopodii* Beardsley	*Lycopodium crenuum*	Oahu
21.	*Pseudococcus mendiculus* Ferris	*Myrsine* sp.	Maui
22.	*Pseudococcus montanus* Ehrhorn	*Freycinetia arborea*	Oahu, Hawaii
23.	*Pseudococcus nudus* Ferris	*Dubantia* sp.	Maui, Hawaii
24.	*Pseudococcus pipturicolus* Beardsley	*Pipturus* sp.	Oahu
25.	*Pseudococcus swezeyi* Ehrhorn	*Acacia koa*	Oahu
26.	*Pseudococcus syzygii* Beardsley	*Eugenia* (*Syzygium*) *sandwicensis*	Oahu
27.	*Pseudotrionymus multiductus* (Beardsley)	*Eugenia* (*Syzygium*) *sandwicensis*	Oahu
28.	*Pseudotrionymus refertus* (Ferris)	*Eugenia* (*Syzygium*) *sandwicensis*	Kauai, Oahu

TABLE 1. *Host and Distribution Records of Endemic Hawaiian Pseudococcidae* (Contd.)

	Species	*Hosts*	*Distribution*
29.	*Tomentocera haleakala* Beardsley	*Coprosma monticola*	Maui
30.	*Trionymus insularis* Ehrhorn	*Eragrostis variabilis, Deschampsia australis*	Laysan, Lisianski, Pearl and Hermes, Kauai, Oahu, Maui, Hawaii
31.	*Tympanococcus tympanistus* (Ferris)	*Metrosideros polyrmorpha*	Maui, Hawaii

7-segmented; legs moderately small, hind coxae without micropores, tarsal claws without a tooth-like projection on inner margin. Anal ring at posterior margin of body, small, cellular, bearing 6 setae. Ventral circulus absent; dorsal ostioles small, relatively inconspicuous or absent. Anal lobes slightly to moderately protuberant. Two to 17 pairs of marginal cerarii present; anal lobe cerarii with from 2 to several very large conical setae, associated trilocular pores few (8 to 10 maximum) or absent; slender accessory setae reduced to 2 or 3, or absent, when present, no longer than conical setae; anterior cerarii with 2 to 4 (rarely 5) large conical setae, sometimes with surrounding derm distinctly sclerotized, associated trilocular pores few or absent, slender accessory setae absent or very short. Body with sparsely scattered trilocular pores, often reduced to very few on dorsum; generally with sparse fine setae; dorsal setae sometimes spine-like. Tubular ducts and multilocular disc pores absent. Known species confined to ferns, inhabiting pinnule-tip galls or deformed pinnules, or occurring exposed on under surfaces of fronds.

Although the genus superficially resembles *Pedronia* Green (type *P. strobilanthis* Green from Ceylon) it differs in lacking large conical setae on the dorsum, micropores on the hind coxae, multilocular disc pores and tubular ducts.

The following 5 species belong here:

Nesopedronia hawaiiensis (Ferris), new combination.
Pedronia hawaiiensis Ferris, 1948, Insects of Hawaii 5: 108, fig. 97. Beardsley, 1957, Proc. Hawaiian Entomol. Soc. 16(2): 220.

Nesopedronia cibotii (Beardsley), new combination.
Pedronia cibotii Beardsley, 1957, Proc. Hawaiian Entomol. Soc. 16(2): 222, fig. 2.

Nesopedronia dura (Beardsley), new combination.
Pedronia dura Beardsley, 1957, Proc. Hawaiian Entomol. Soc. 16(2): 224, fig. 3.

Nesopedronia crypta (Beardsley), new combination.
Pedronia crypta Beardsley, 1957, Proc. Hawaiian Entomol. 16(2): 226, fig. 4.

Nesopedronia acanthocauda (Beardsley), new combination.
Pedronia acanthocauda Beardsley, 1957, Proc. Hawaiian Entomol. Soc. 16(2): 230, fig. 5.

Pseudotrionymus, new genus.

Type of genus: *Trionymus multiductus* Beardsley.

Recognition characters: Body at maturity elongate-oval; derm membranous. Antennae 8-segmented; legs moderately elongate, hind coxae without micropores, tarsal claws without a tooth-like projection on inner face. Anal ring at posterior apex of body, cellular, with 6 setae. Ventral circulus absent; two pairs of dorsal ostioles present, moderately well developed. Anal lobes weakly to moderately protuberant, each bearing a cerarius consisting of several (usually 3 to 8) conical setae plus several slender accessory setae, and a concentration of trilocular pores, surrounding derm slightly to moderately well sclerotized. Penultimate cerarii usually present, with from one to 6 conical setae plus a few slender accessory setae and a slight to moderately dense concentration of trilocular pores. Anterior cerarii absent. Trilocular pores scattered on dorsum and venter very sparse to moderately dense. Small, shallow oral collar tubular ducts sparsely to densely distributed or dorsum and venter; without large oral-rim tubular ducts. Multilocular disc pores usually absent, occasionally with one such pore near vulva in one species. Dorsum and venter with sparsely scattered fine setae.

The two species now placed in this genus previously were assigned to *Trionymus* Berg. *Pseudotrionymus* differs from the latter in the possession of more than 2 conical setae on the anal lobe cerarii, the nearly complete absence of multilocular disc pores (normally numerous in *Trionymus*) and the absence of micropores in the hind coxae (normally conspicuously developed in *Trionymus*). In addition, the small shallow tubular ducts of *Pseudotrionymus* are a type not found in *Trionymus* which has relatively slender elongate ducts.

Both the included species inhabit cavities in deformed leaves of *Eugenia* (*Syzygium*) *sandwicensis*. Each species produces its own characteristic type of leaf deformation (Beardsley, 1959).

Pseudotrionymus refertus (Ferris), new combination.
Trionymus refertus Ferris, 1948, Insects of Hawaii 5: 261, fig. 141.

Pseudotrionymus multiductus (Beardsley), new combination.
Trionymus multiductus Beardsley, 1959, Proc. Hawaiian Entomol. Soc. 17(1): 52, fig. 5.

Ohiacoccus, new genus.

Type of genus: *Ohiacoccus cryptus*, new species.

Recognition characters: Body at maturity broadly oval or nearly circular, rather strongly sclerotized throughout; newly molted adult females more slender, body often somewhat pyriform, derm partly scle-

rotized to largely membranous, depending upon age. Antennae 6-segmented; legs fairly small, hind coxae without micropores, tarsal claws without a tooth-like projection on inner margin. Anal ring at posterior apex in young adults, becoming displaced anteriorly on the venter in fully mature females (due apparently to distension of the body), small, cellular, bearing 6 setae. Anal lobes very weakly protuberant in young females, nearly obliterated in fully mature specimens, each bearing a cerarius consisting of a single large conical seta and a few spine-like setae, with a few associated trilocular pores; without long slender accessory setae. Anterior cerarii not developed. Ventral circulus absent; two pairs of small dorsal ostioles present. Body with sparse, scattered trilocular pores and sparse short setae; tubular ducts and multilocular disc pores absent.

Ohiacoccus resembles *Trionymus* Berg and certain other grass-infesting genera which are characterized by having the cerarii greatly reduced in number and confined to the posterior end of the abdomen. However, the complete absence of multilocular disc pores and tubular ducts suggests that *Ohiacoccus* is not closely related to these. Among the endemic Hawaiian genera, *Ohiacoccus* seem closest to species of *Nesopedronia*, like *N. dura* and *N. crypta*, which also have the derm sclerotized at maturity and lack multiloculars and tubular ducts. However, all the known *Nesopedronia* either have many more cerarii developed, or the anal lobe cerarii have multiple conical setae.

Ohiacoccus cryptus, new species (Fig. 1).

Adult female. Boby at maturity nearly circular in outline, derm partly to almost entirely sclerotized, length of slide-mounted specimen about 1.3 mm. Young adult specimen with derm largely membranous, oval in shape, around 0.8 mm long. Antennae 6-segmented, short (about 200 μ long). Labium short (about 75 μ long), base broad (60–70 μ). Legs short and stout; hind femora about 85 μ long, hind tibiae about 80 μ; hind tarsi about 60 μ; micropores on upper face of hind legs very few or absent, 2 or 3 sometimes discernible on femora. Eyes well developed with a definite sclerotized basal cone. Dorsal ostioles small; moderately to distinctly sclerotized on margins of lips even in young adult specimens. Anal ring about 40 μ wide, anal ring setae about 60 μ long. Anal lobe cerarii (young adult) each consisting of a single large apical conical seta about 20 μ long, plus 2 or 3 much more slender spine-like setae about the same length or shorter, borne on a small sclerotized area; usually with a single trilocular pore near base of conical seta. Anal lobe seta about 70 μ long, situated ventrally anterior to the base of the conical seta. Setae on posterior part of body generally short (10 to 15 μ long), slightly spiniform. Some longer more slender setae on head and thorax. Trilocular pores evenly, rather sparsely scattered on dorsum; confined mainly to marginal areas of venter; with a slight concentration of pores near spiracular openings. No other types of pores or ducts discernible.

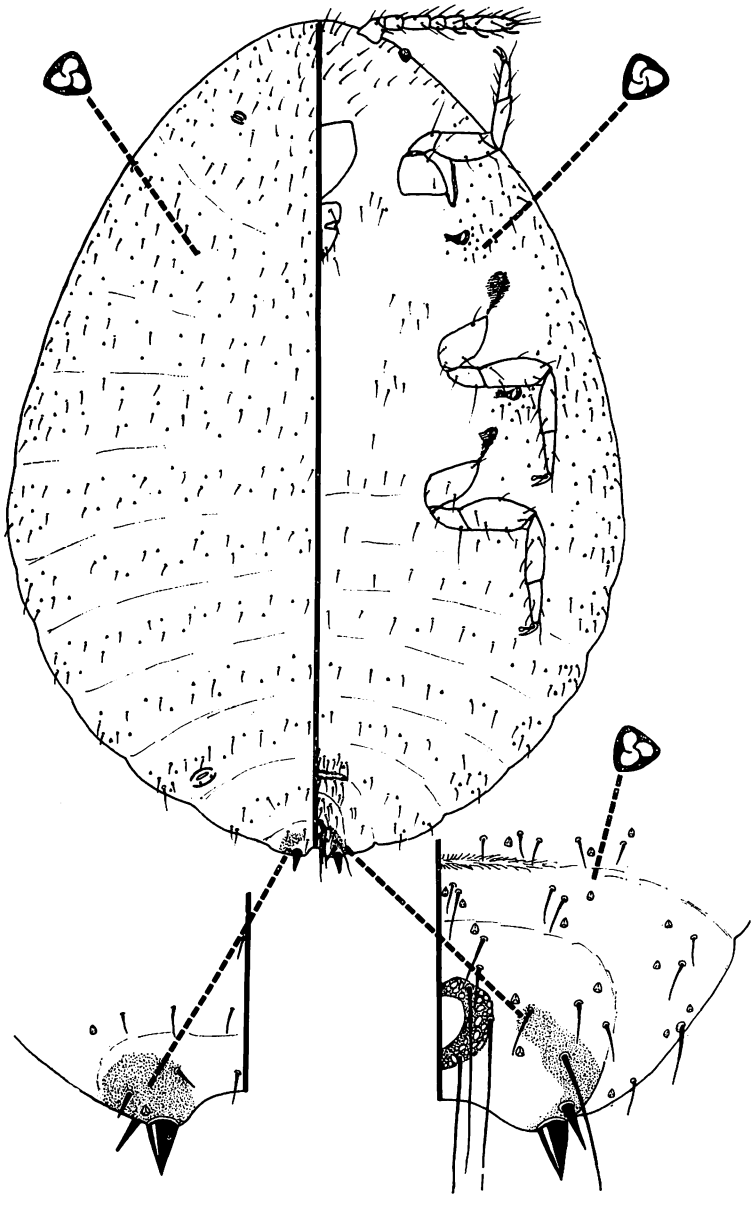

FIG. 1. *Ohiacoccus cryptus*, new species; young adult female.

Described from 16 specimens. Holotype (young female) and paratype (sclerotized female) on one slide: Ridge above Kolekole Pass, Waianae Mts., Oahu, 2,500 ft. IV-17-1965, J. W. Beardsley, on *Metrosideros polymporpha* form *typica*, in thick tomentum at base of petiole of young leaf. 14 paratypes on six slides, same data as type. Additional specimens: Mt. Hualalai, Hawaii, 4,000 ft., VII-28-1966; same collector and host data; Saddle Road, 14 mi. West of Hilo, Hawaii, 4,000 ft., VII-22-1970, same collector and host data.

This mealybug seems highly specialized to inhabit a particular small protected niche. All the specimens were found at the bases of leaf petioles where these were tightly appressed to the twigs and where the insects imbeded in thick tomentum which is characteristic of the *typica* variety of ohia. Usually there were not more than 1 or 2 bugs on each petiole. Despite considerable searching, none were ever found on the glabrous forms of ohia. Many of the specimens collected had been parasitized by an apparently undescribed endemic *Anagyrus* species.

Gallulacoccus, new genus.

Type species: *Gallulacoccus tenorioi*, new species.

Recognition characters: Body at maturity turbinate, cephalothorax broadly rounded, abdomen tapering posteriorly to a relatively narrow apex; derm largely membranous. Antennae 7-segmented; legs of moderate size, tarsal claws without a tooth-like projection on inner face, hind coxae without micropores. Anal ring well developed, cellular, with six long setae. Ventral circulus absent; two pairs of small dorsal ostioles present. Anal lobes slightly protuberant. With two pairs of well-defined marginal cerarii, on anal lobes and penultimate abdominal segment respectively, each with two conical setae and several somewhat spiniform accessory setae; anterior cerarii absent, or represented by 1 or 2 relatively small, slender conical setae on margins of abdominal segments 5 and 6. Body with numerous small oral rim tubular ducts distributed on dorsum of abdomen, a few on dorsum of head and thorax and along lateral margins or venter. Oral collar ducts and multilocular disc pores absent. Body setae moderately sparse, dorsal setae of abdomen moderately elongate and weakly spiniform, remainder of setae fine.

The shape of the body of *Gallulacoccus* is rather similar to that of *Turbinococcus pandani* (Takahashi) from the Palau Islands. However, the latter possesses ventral multilocular disc pores and lacks the small oral rim tubular ducts which are characteristic of *Gallulacoccus*. Among endemic Hawaiian forms, the reduced number of cerarii, and numerous tubular ducts of this genus suggests a possible relationship with *Pseudotrionymus*.

Gallulacoccus tenorioi, new species (Fig. 2).

Body form turbinate, broadest across mesothorax, rounded anteriorly;

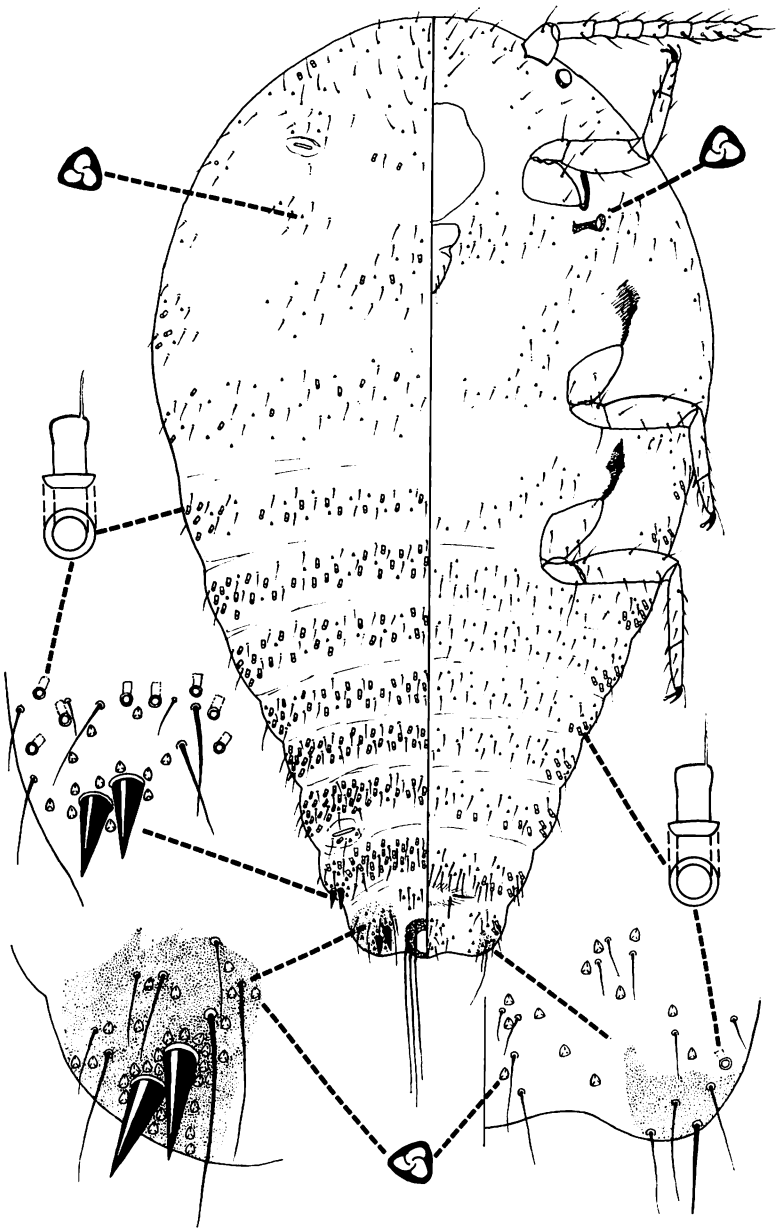

FIG. 2. *Gallulacoccus tenorioi*, new species; adult female.

abdominal segments becoming progressively narrower posteriorly. Derm membranous; length of slide-mounted specimen about 1.25 mm. Antennae 7-segmented, about 260 μ long; labium moderately slender, about 120 μ long, 85 μ wide at base. Legs of moderate size, hind femora about 150 μ long, hind tibiae about 120 μ, hind tarsi about 65 μ; upper surface of hind femora with 20 to 30 micropores, hind tibiae with 15 to 20 micropores. Anal ring well developed, about 75 μ wide; anal ring setae elongate (about 200 μ long). Anal lobes rounded, not noticeably protuberant; anal lobe seta about 100 μ long. Anal lobe cerarii large and well developed, each with 2 large conical setae about 30 μ long plus several (usually 6 to 8) slender accessory setae, the longest about 80 μ, and a cluster of trilocular pores around bases of conical setae; borne on a large, well defined, sclerotized plate. Penultimate cerarii each with 2 somewhat smaller conical setae (around 23 μ long) with several trilocular pores around their bases, without closely associated accessory setae and with surrounding derm unsclerotized. Anterior cerarii represented by 1 or 2 small conical setae about 15 μ long on abdominal segments 5 and 6; absent on anterior abdominal segments or cephalothorax. Dorsum with numerous small oral rim ducts, about 4.5 outside diameter and about 7 μ deep. A band of around 50 such ducts extending across dorsum of abdominal segments 3 to 7; less numerous on segments 1 and 2; very few on dorsum of head and thorax; absent on dorsum of abdominal segment 8. Similar ducts present along lateral margins of venter as far forward as metathorax (1 or 2 on each side abdominal segment 8, 7–9 on segments 6 and 7; 3 to 6 on other segments. Dorsum of abdomen with relatively few trilocular pores scattered among tubular ducts; trilocular pores sparsely scattered on other areas of body. Body setae of dorsum of posterior abdominal segments moderately elongate (15–40 μ), slightly spiniform; ventral abdominal setae somewhat shorter and finer. Setae of anterior abdominal segments and thorax mostly 8–20 μ; head with longer setae dorsally and ventrally anterior to head skeleton, up to 60 μ.

Described from 7 specimens. Holotype and 6 paratypes on 7 slides: Kahili Mt., Kauai, XI-17-1968, J. A. Tenorio, ex galls on leaves of *Metrosideros* leaf. The *Metrosideros* from which the specimens were obtained appears to belong to one of the glabrous-leaf varieties of *M. polymorpha.* The mealybugs were taken from small, shallow pocket galls in the leaves of the host. These resemble the galls of certain psyllids (*Trioza* spp.) which attack *Metrosideros* in Hawaii, but are smaller in size. The dome-shaped galls open on the lower surface of the leaves, though a circular aperature about 1 mm in diameter, and protrude 1.5 to 2 mm above the upper surface. The apertures of inhabited galls generally were filled with white waxy secretions through which the caudal wax filaments of the mealybugs sometimes extended.

Chlorococcus, new genus.

Type of genus: *Chlorococcus longipes*, new species.

Recognition characters: Body at maturity elongate-oval, derm membranous. Antennae normally 8-segmented; legs well developed, moderately to distinctly elongate, hind coxae without micropores, tarsal claws without a tooth-like projection on inner margin. Anal ring at posterior end of body, bearing six ring setae. Ventral circulus present, frequently large; two pairs of dorsal ostioles present. Anal lobes moderately to distinctly protuberant. With from 3 to 17 pairs of marginal cerarii; anal lobe, interantennal, and at least one thoracic pair of cerarii present; slender accessory setae associated with most or all of the cerarii. Dorsum usually with a submarginal series of large oral collar ducts, sometimes tending to weakly developed oral rims; with orifices sometimes enclosed by patches of sclerotized derm; dorsal ducts absent in one species. Normally developed oral rim ducts absent. Multiocular disc pores absent or greatly reduced in number, a maximum of 4, all situated in immediate vicinity of vulva, in known species. Small ventral oral collar tubular ducts absent or reduced to a few on posterior abdominal segments. Trilocular pores sparsely distributed, dorsal triloculars sometimes distinctly larger than ventral. Body setae fine, generally sparse. Color of living mealybugs pale to bright green.

This genus is erected for a group of apparently related endemic Hawaiian species. The three species described previously were, until now, assigned to *Pseudococcus* Westwood. It seems clearly evident that these unusual green-colored species are not closely allied to *P. longispinus* (Targioni-Tozzetti), the type of *Pseudococcus;* nor can they be assigned with confidence to any other described genus. *Chlorococcus* seem to be most closely related to *Tympanococcus* Williams, the type of which is *T. tympanistris* (Ferris), also apparently an endemic Hawaiian form (see below). It differs from the latter in having fewer large tubular ducts which are absent on the venter in *Chlorococcus* and are of a more elongate type; other important differences are the virtual absence of multilocular disc pores, and the paucity of small ventral oral collar ducts in *Chlorococcus*. The green color of living *Chlorococcus* species is unusual for mealybugs. It appears that all of the known species normally occur on the undersurfaces of host leaves. They produce very little of the powdery white wax which thickly covers the dorsal surface of many mealybug species. Their green color approximates that of the leaf surfaces which they inhabit.

Key to Species of *Chlorococcus*

1. With 3 pairs of cerarii, an anal lobe pair, an interantennal pair, and a metathoracic pair; circulus small; dorsal submarginal oral collar ducts numerous (more than 30 per side), relatively small (6–8 μ diameter); on *Pelea*.....*peleae*

— With 12–17 pairs of cerarii; circulus large; dorsal submarginal oral collar ducts fewer (less than 30 per side or absent), size larger (10 μ diameter or more); on other hosts.....2

2. Dorsal submarginal oral collar ducts absent; on *Straussia, Bobea,* and *Gouldia* (Rubiaceae).....*straussiae*

— Dorsal submarginal oral collar ducts present; on other hosts.....3

3. Orifices of dorsal tubular ducts surrounded by a patch of sclerotized derm; appendages not conspicuously elongate.....4

— Orifices of dorsal tubular ducts with surrounding derm unsclerotized; antennae and legs relatively very long and slender; on *Myrsine*.....*longipes*

4. With 17 pairs of marginal cerarii; both submarginal and submedial dorsal tubular ducts present (total 10–12 per side) ducts relatively small (about 10 μ diameter); on *Sophora*.....*chloris*

— With 12 to 14 pairs of cerarii, dorsal tubular ducts present in a submarginal series only, usually 7 per side, ducts very large (about 20 μ diameter); on *Clermontia*.....*sparsus*

Chlorococcus straussiae (Ehrhorn), new combination.

Pseudococcus straussiae Ehrhorn, 1916, Proc. Hawaiian Entomol. Soc. 3(3): 239. Zimmerman, 1948, Ins. Hawaii 5: 241, fig. 132.

Ehrhorn (1916) reported this species from Oahu on *Straussia* and from Molokai on *Myrsine.* Zimmerman (1948) records it also from *Gouldia* and *Charpentiera obovata.* I have collected or examined specimens from Kauai, Oahu and Maui taken on *Straussia, Gouldia* and *Bobea,* all endemic members of the family Rubiaceae. The records from *Myrsine* and *Charpentiera* are probably misidentifications. A similar appearing but distinct new species from *Myrsine* is described below.

Chlorococcus peleae (Beardsley), new combination.

Pseudococcus peleae Beardsley, 1959. Proc. Hawaiian Entoml. Soc. 17(1): 47, fig. 3.

This species is known only from the type locality in the Koolau Mts., Oahu. The host is *Pelea clusiaefolia* Gray.

Chlorococcus chloris (Beardsley), new combination.

Pseudococcus chloris Beardsley, 1963. Proc. Hawaiian Entomol. Soc. 18(2): 230, figs. 1, 2.

Mature females of this species are bright green in life. It has been collected from *Sophora chrysophylla* (Salisbury) Seemann, on Hawaii and Maui.

Chlorococcus longipes, new species (Fig. 3).

Adult female. Body form elongate-oval; widest at about second abdominal segment; length of slide mounted specimen about 1.5 mm. Antennae 8-segmented, conspicuously elongate (about 0.8 mm long). Legs long and slender; hind femora about 350 μ, hind tibiae about 350 μ,

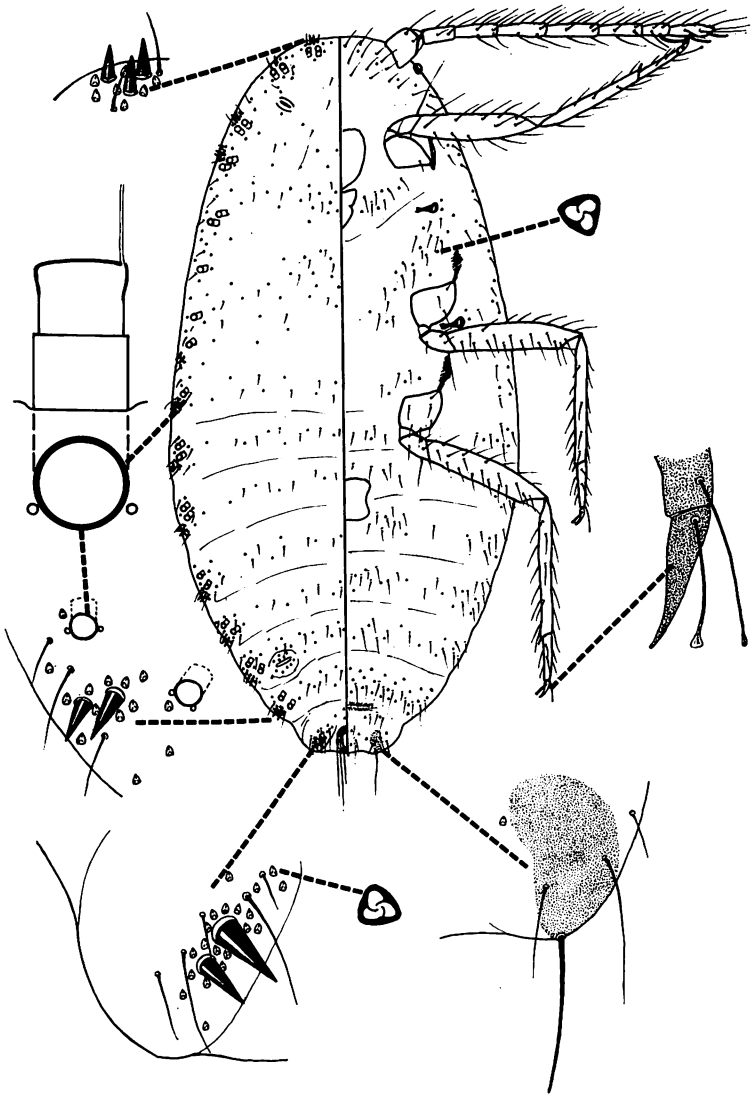

FIG. 3. *Chlorococcus longipes*, new species; adult female.

hind tarsi 125 μ, and hind tarsal claw 50 μ long. Hind legs with a few micropores on upper surfaces, 15–20 on femora, 10–15 on tibiae. Labium short and broad, about 85 μ long by about 85 μ wide at base. Eyes prominent, with well developed sclerotized basal cone. Anal ring about 70 μ wide; ring setae about 110 μ long. Two pairs of dorsal ostioles present; lips unsclerotized. Circulus large, about 100 μ wide. Usually with 12 or 13 pairs of marginal cerarii, one pair on each abdominal seg-

ment, two pairs on head, and remainder on thorax. Anal lobe cerarii each with two conical setae of unequal size, the larger about 20 μ and the smaller about 15 μ long; plus 4 or 5 slender accessory setae about 42 μ maximum length. A small concentration of trilocular pores around bases of conical setae; surrounding derm unsclerotized. Penultimate cerarii each with 2 conical setae 11 to 13 μ long plus 2 or 3 slender accessory setae and a few trilocular pores. Anterior cerarii usually with 2 conical setae (occasionally one) 9 to 11 μ long, plus one or 2 slender accessory setae (sometimes absent) and a few trilocular pores; interantennal cerarii normally with 3 conical setae. Dorsum with a submarginal series of large oral collar ducts, about 10 μ outside diameter and 15 μ deep; each usually with 1 to 3 small circular micropores near collar margin; derm surrounding ducts unsclerotized. These ducts present on head, thorax, and all abdominal segments anterior to the eighth; usually a pair of ducts on each side near cerarii on head and abdomen; one or two ducts near each thoracic cerarius and sometimes near sites of missing cerarii. Total number of ducts on each side ranging from 24 to 27. Dorsum with very sparsely scattered trilocular pores and scattered fine setae mostly 10 to 20 μ long. Venter with very sparsely scattered trilocular pores; multilocular disc pores and tubular ducts absent. Ventral setae conspicuously longer than dorsal, mostly 35 to 75 μ long, up to about 100 μ on venter of head.

Described from 34 specimens. Holotype and 33 paratypes on 14 slides: Waikamoi Stream, East Maui, 4,000 ft., VIII-24-1965, J. W. Beardsley, on leaves of *Myrsine* sp., probably *lessertiana*.

In life mature females were pale green in color. The dorsal surface bore numerous fine thread-like filaments of glassy wax, broken fragments of which adhered to leaf surfaces around the mealybugs. These filaments issued from the submarginal oral collar ducts. Fine, white, peripheral wax filaments arising from the cerarii were also present. The anal lobe filaments were about one-half to two-thirds as long as the body, while the length of the lateral filaments generally was equal to about half the width of the body. The dorsal surface was very lightly dusted with powdery wax.

Superficially living colonies of *C. longipes* closely resemble those of *C. straussiae* (Ehrhorn). The latter lacks dorsal tubular ducts and consequently does not produce fine threads of glassy wax, but otherwise is generally similar in color, shape and size. Among the species here assigned to *Chlorococcus*, *C. longipes* seems most similar to *C. peleae* (Beardsley). It differs from the latter in having somewhat larger but less numerous dorsal tubular ducts, many more pairs of cerarii, longer appendages, larger circulus, and other details.

Chlorococcus sparsus, n. sp. (Fig. 4).

Adult female. Length of slide-mounted specimen about 2.7 mm. Antennae 8-segmented, about 0.5 mm long. Labium broadly triangular,

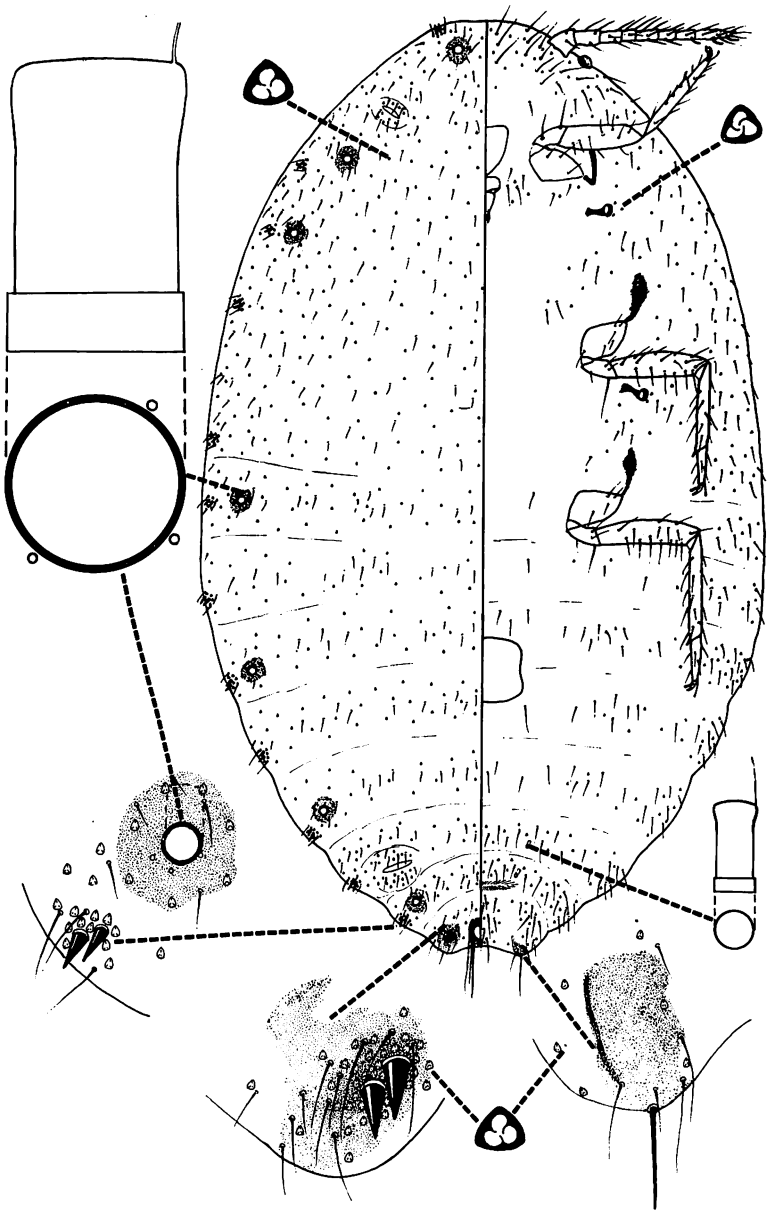

FIG. 4. *Chlorococcus sparsus*, new species; adult female.

about 125 μ long, 125 μ wide at base. Legs moderately large, hind femora about 330 μ long; hind tibiae about 330 μ; hind tarsi 130 μ; hind tarsal claw 30 μ. Upper surface of hind femora with around 12–20, and hind

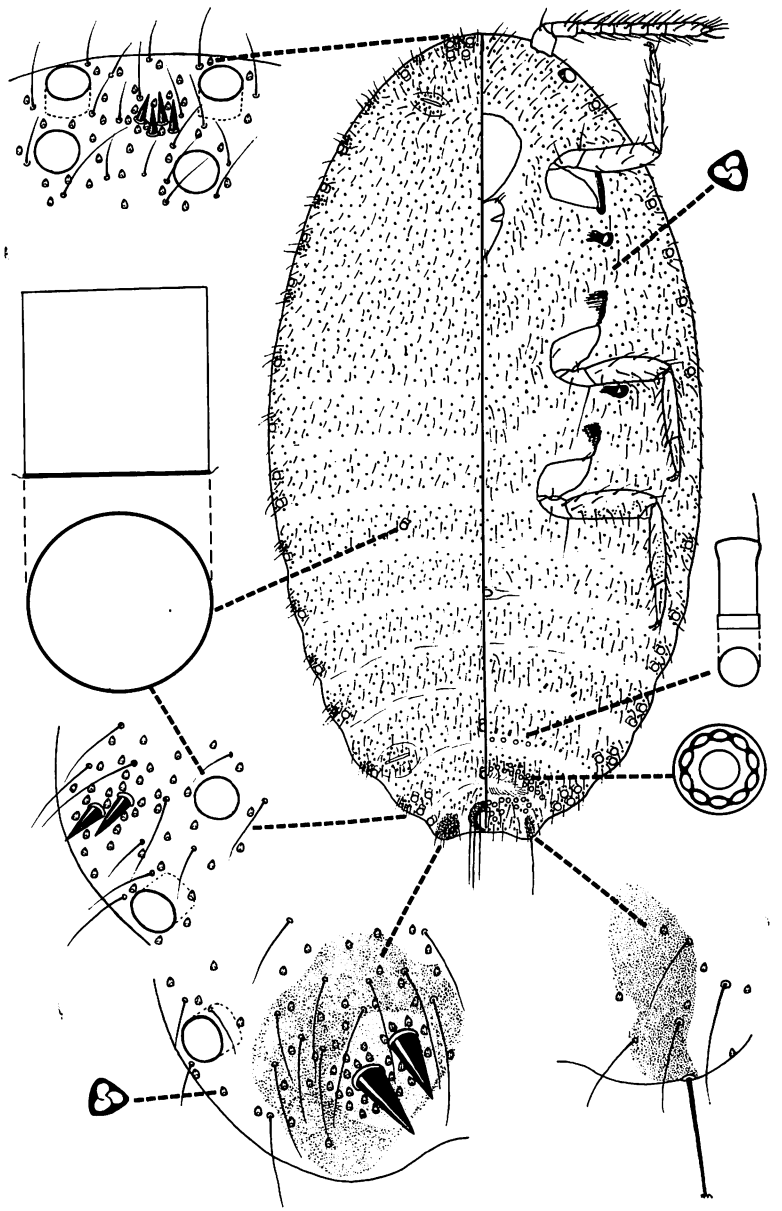

FIG. 5. *Tympanococcus tympanistus* (Ferris) adult female.

tibiae with around 30–40 micropores. Anal ring about 90 μ wide; ring setae 150–160 μ long. Anal lobes moderately protuberant; anal lobe setae about 140 μ long. Two pairs of dorsal ostioles present, lips unsclerotized. Circulus large, about 240 μ wide.

With 12 to 14 marginal cerarii on each side; usually with one pair on each abdominal segment, an interantennal pair on head, and remainder on thorax. Anal lobe cerarii each with two conical setae about 28 μ long, their bases surrounded by a cluster of trilocular pores; plus several (usually 6–9) slender accessory setae about 45 μ maximum length; surrounding derm slightly to moderately sclerotized. Penultimate cerarii each with 2 smaller conical setae (about 20 μ long) plus 3 or 4 slender accessory setae and a slight concentration of trilocular pores; surrounding derm unsclerotized. Anterior abdominal and thoracic cerarii similar to penultimate, occasionally on thorax reduced to a single conical seta; interantennal cerarii usually with 3 conical setae, otherwise similar. Dorsum usually with 7 large oral collar ducts on each side, situated submarginally near cerarii as indicated in figure; each duct with outside diameter of about 20 μ, about 30 μ deep; each usually with 2 or 3 circular micropores near duct rim; derm surrounding duct aperture (usually including several adjacent trilocular pores and setae), distinctly sclerotized. Dorsum with sparsely scattered trilocular pores about 5 μ wide plus sparse setae mostly 15 to 35 μ long. Venter of anal lobes with a well defined sclerotized area, appearing most heavily sclerotized in band along its mesal margin. Venter with a very few (maximum of 4 in available specimens) small oral collar ducts, about 3 μ diameter, on posterior abdominal segments near vulva. Multilocular disc pores absent. Ventral trilocular pores slightly smaller than dorsal (about 4 μ wide), very sparse on anterior abdominal segments. Ventral setae generally somewhat longer than dorsal, mostly 25 to 50 μ long, up to 65 μ near vulva, up to about 110 μ on head.

Described from 4 specimens. Holotype and 3 paratypes on 4 slides: Honokawai Stream, West Maui Mountains, 3,000 ft., near Flemming's mountain house, VIII-25-1965, J. W. Beardsley, on leaves of *Clermontia arborescens*.

The adult mealybugs were pale green in life and were found singly on under surfaces of host leaves. Living insects exhibited fine white caudal wax filaments up to about two-thirds as long as the body, plus 10 or 12 similar short lateral filaments with lengths equal to about one-half the width of the body. Also, there were some extremely long, fine, glassy wax filaments, up to 3 or 4 times as long as the body, extending from lateral margins of dorsum. The white filaments appeared to arise from the cerarii, while the fine glassy filaments each issued from one of the large submarginal tubular ducts.

This species appears most similar to *C. chloris* (Beardsley). It can

be separated from the latter by the larger but less numerous dorsal oral collar ducts, reduced number of cerarii, and other details.

Genus **Tympanococcus** Williams

Williams (1967) erected this genus to accommodate two species with unusual, large, drum-like tubular ducts. The type species, *T. tympanistus* (Ferris), was from a single collection from Haleakala, Maui, the host of which is unknown. The second included species is from the Philippine Islands, collected on *Gardenia* species, taken in quarantine at Honolulu.

Recently, *T. tympanistus* has been collected at several localities on the Island of Hawaii. In every case the mealybugs were found beneath bark on trunks and branches of Ohia (*Metrosideros polymorpha*), establishing for the first time the host of this unusual species. Although Williams suggested that *T. tympanistus* might not be endemic to Hawaii, I believe there is good evidence that it is. Beside the fact that it has been collected only on native Hawaiian Ohia, I found many individuals which were parasitized by an encyrtid wasp belonging to the endemic Hawaiian complex of *Anagyrus* species. Previous work has shown that these encyrtids are highly host specific and apparently attack only endemic Hawaiian mealybugs.

Morphologically *Tympanococcus* appears to be allied to the endemic genus *Chlorococcus*, described above. It differs in lacking the characteristic green color of the latter group, and in the somewhat different type of large tubular ducts.

The first specimens of *T. tympanistus* collected on Hawaii had noticeably fewer of large drum tubular ducts than did the Maui type specimens. This, together with the possession of somewhat more numerous cerarii, at first led me to consider the Hawaii form as a distinct species. However, additional collections from several localities on Hawaii were made which yielded intermediate forms as well as forms practically identical to the Maui material, so I am now inclined to the view that a single, somewhat variable species is involved. *T. tympanistus* has now been found to be rather widely distributed on ohia trees on Hawaii, below about 4,000 ft. Above that elevation another endemic mealybug, apparently an undescribed species of *Pseudococcus*, seems to replace it.

The figure of *T. tympanistus* given here (figure 5) is based on a specimen from Kipuka Puaulu, Hawaii Volcanoes National Park, and represents the form with reduced numbers of drum tubular ducts which was encountered frequently in that area.

Living specimens of this mealybug were a pale yellowish cream color. The dorsal surface was dusted with powdery whitish wax and short white wax tassels were associated with the marginal cerarii. Numerous long threads of glassy wax, each issuing from one of the large drum tubular ducts, also extended from the body margins.

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